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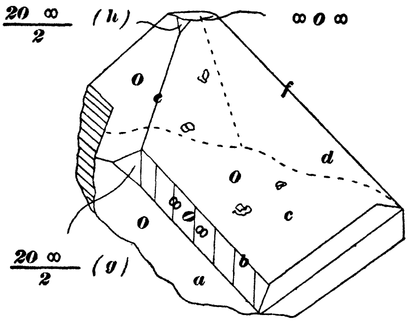
Chloanthite, Nicolite, De Saulesite, Annabergite, Tephrowillemite, Fluorite and Aqvatite from Franklin, N. J.—PROFESSOR GEORGE A. KOENIG stated that on a recent visit to Franklin he obtained from Major de Saules, the manager of the Trotter mine, material of a recent find of nickel ore, in which he identified the above species, of which two are new and the others have not been observed heretofore at this locality. At a depth of 340 feet the shaft passed through a stratum of yellow garnet. Under this a considerable nest of sphalerite and fluorite was met with and with these the bunch of nickel ore was associated, probably 30 pounds. The first and only observation that nickel and cobalt are found at Franklin, dates from 1876, when the speaker described the product of alteration of Jeffersonite under the name of Anomalite (Amer. Inst. of Mining Engineers, 1876). From this substance the reaction of manganese in borax and salt of phosphorus could not be obtained, although it contains over 30% of this metal. The cause of this lies in the presence of nickel and cobalt (about 3%) which together give a green color to the glass and this being complementary to the red of the manganese, extinction results. The present find of nickel minerals is, then, not unexpected, but very interesting.

1. *Chloanthite.*—Forms the main bulk. It is chiefly massive, in thin layers, having a very thin interposition of calcite. The color of the massive portion is light steel-gray. On one specimen, the mineral is bordered by cleavable calcite. All along the border minute white crystals of metallic lustre are imbedded in the calcite. Their habitus is generally prismatic. Fortunately the speaker observed one crystal, $\frac{1}{12}$ inch length of edge, which could be chiseled out from the matrix and was large enough to afford goniometric measurements. The figure shows this crystal in linear enlargement of 1: 18. The crystal is broken off at the left and at the back. On the right front a small crystal appears.



The right front face O and all others of the same position show small protuberances and do not reflect the light completely. However, the reflections obtained were in the main satisfactory.

Edge (*e*) = 70° 24′

Edge (*f*) = 70° 35′ (theoretically 70° 33′)

The face (*b*) is very narrow, striated, and it reflects a drawn image.

$a : b$ = 55° (54° 44′) $b : c$ = 54° 30′ (54° 44′)

$a : c$ = 109° 30′ (109° 28′)

$a : d$ = 180°

From these measurements it follows that the crystal belongs to the *isometric* system; the combination being O, ∞ O ∞. The faces (*g* and *h*) belong to a pentagonal dodecahedron, whose symbol is $\frac{20\infty}{2}$ because $g : b = 24° 30'$ (uncertain owing to the strongly blurred condition of the weak reflection; 20 ∞ requires 26° 30′). This form should occur, however, in symmetrical pairs of faces. It is observed here only in single faces. The upper apex is quite perfect and so is the front apex, yet there is no indication in either case of a companion face. A tetartohedral development must therefore be assumed in this instance.

Specific gravity = 6.8334 at 24° C. B. B. In closed tube it yields a sublimate of metallic arsenic. On charcoal it does not fuse until a large quantity of arsenic has been volatilized. Heated with a borax head in the O. H. on charcoal, a blue glass is obtained for some time, then a brown glass. (Cobalt and Nickel.)

The analysis gave:

Arsenic	=	70·66	0·9421	0·9902
Sulphur	=	1·54	0·0481	
Nickel	=	18·63	0·3185	0·4685
Cobalt	=	6·37	0·1087	
Iron	=	2·31	0·0413	
Zinc	=	trace		
Ca CO^3	=	0·89		
		100·40		

The atomic ratio therefore:

(As, S) : (Ni, Co, Fe) = 2· 11 : 1

It is further notable that

Fe : Co : Ni = 1 : 3 : 9 very nearly.

2. *Nicolite.*—This species has been observed only in a few small grains in connection with the following species. It is recognized by the peculiar color.

3. *De Saulesite,* a zinciferous variety of Garnierite.—This species occurs as a crust and as the filling of the cavities in a deeply purple fluorite. It is associated with Chloanthite in such a manner, that the most probable inference to be drawn is, that the arsenide is not the original, but was crystallized either at the same time or later than the silicate. Chloanthite is disseminated in very minute prismatic crystals all through the green silicate. This latter is built up loosely in grate-like forms, assuming the texture of certain sponges. The linear, intersecting, cylindroid rods are covered with roughly polyhedral excrescences which seem to be crystalloid bodies. Besides this form, which has been reported for the Algerian Garnierite, the green mineral appears less frequently in massive, compact, bluish-green bands, bordered by Chloanthite. It resembles in this form certain serpentines, from which, however, its softness readily distinguishes it. The color varies from yellowish-green to bright

apple and emerald-green. The material for the analysis was picked with the utmost care, especially to exclude the minutest crystals of chloanthite. The quantity analyzed was 0·2805 gram. In closed tube it yields water and turns brown. It is infusible even in the Bunsen blowpipe, but the green color returns at this high temperature, and the specimen looks as if it had not changed. It gives with the fluxes only nickel reaction. It is easily decomposed by hydrochloric acid, a little less after ignition, and separates flocculent silica. Owing to the scantiness of material, the substance was first ignited then digested with concentr. hydrochloric acid over night. The silica was then fused with sodic carbonate, when it was observed that it had lost 10%, showing that 90% of the ignited silicate had been decomposed by the acid. The analysis gave:—

$\mathrm{Si\,O^2}$ = 31·62
$\mathrm{Ni\,O}$ = 38·22
$\mathrm{Zn\,O}$ = 4·00
$\mathrm{Fe\,O}$ = 2·03
$\mathrm{Ca\,O}$ = 0·70
$\mathrm{Mg\,O}$ = 0·42
$\mathrm{As^2\,O^5}$ = 4·77
$\mathrm{H^2\,O}$ = 16·58 $\left\{\begin{array}{l}\text{9·44 at 100° C.}\\ \text{7·14 at 600° C.}\end{array}\right.$
97·71

The arsenic oxide is undoubtedly contained as such in the mineral. Let it be assumed then that it is admixed in the form of Annabergite, there will be:

$\mathrm{Si\,O^2}$	= 31·02	Coeffic:	0·5017	
$\mathrm{Ni\,O}$	= 33·62		0·4508	
$\mathrm{Tn\,O}$	= 4·00		0·0490	
$\mathrm{Fe\,O}$	= 2·03		0·0290	
$\mathrm{Ca\,O}$	= 0·71		0·0120	0·5408
$\mathrm{Mg\,O}$	= 0·42			
$\mathrm{H^2\,O}$	= 13·58		0·7500	
$\mathrm{As^2\,O^5}$	= 4·77	Annabergite.		
$\mathrm{Ni\,O}$	= 4·60			
$\mathrm{H^2\,O}$	= 3·00			

For the silicate the ratio will be

$\mathrm{(Ni, Zn, Fe)\,O : Si\,O^2 : H^2\,O}$
0·5408 : 0·5017 : 0·75
1·08 : 1 : 1·5

This is the ratio exactly, given by Groth for Garnierite. (Tabell. Uebersicht, 2 Aufl.) The question remains, however, is Garnierite an Ortho-or a Metasilicate? Groth takes the latter alternative, writing the formula

$\mathrm{H^2\,(Ni, Mg,)\,Si\,O^4.}$ ½ aq.

To the speaker this view does not seem confirmed by the present results. The water is expelled too readily, over one-half at 100° C., and he would write the formula

$\mathrm{(Ni, Tu, Fe)\,Si\,O^3.}$ 1½ aq.

as a metasilicate.

Experimenting with some Garnierite from Africa, the speaker observed that the mineral behaves like the present one. It turns *brown* and in a strong heat again green, not *black* as Damour states: (Zeitschr. f. Crystallogr. Mineralogie, vol. iii, p. 636.) The speaker thinks it proper to distinguish this zinciferous Garnierite by a new name and proposes *De Saulesite* in honor of Major A. B. de Saules, E. M., the present manager of the Trotter mine, to whose kindness in furnishing the material, the author is much indebted and herewith expresses his thanks.

4. *Tephrowillemite*, an intermediate species. The speaker received from Master Percy de Saules a broken crystal, found at the same depth as the preceding minerals in the Trotter mine. The crystal fragment shows two faces which intersect in an edge 1,5 inch long, conforming to 120° measured with a hand goniometer. The crystal is imbedded in well cleaving gray calcite. Its substance is very homogeneous, showing under the microscope but a few very small black grains, most probably Franklinite.

The color is brownish-gray. Lustre resinous, unctuous. B. B. Is infusible; yields no water; furnishes on charcoal a zinc incrustation and with the fluxes a strong manganese reaction. It gelatinizes completely with cold, concentrated hydrochloric acid.

The mean of two analyses gives:—

$\mathrm{Si\,O^2}$	= 27·75		0·4925	
$\mathrm{Zn\,O}$	= 60·61		0·7302	.8912
$\mathrm{Mn\,O}$	= 10·04		0·1360	
$\mathrm{Fe^2\,O^3}$	= 2·00	= 1·80 $\mathrm{Fe\,O}$	0·0250	
$\mathrm{Ca\,O}$	= trace			
	100·40			

Under the supposition that the iron is all ferrous, the ratio obtains:—

$\mathrm{Si\,O^2}$: (Tn, Mn, Fe) =
0·4925 : 0·8912
1 : 1·85 =1 : 2

The formula is, therefore:—

$(\mathrm{Zn, Mn, Fe})^{2}\,[\mathrm{Si\,O^4}]$

5. *Fluorite.*—Whilst the species had been found in the mass of the white marble in the quarries south-west of the furnace, it had not previously been noticed within the ore body. The speaker observed it in very light pink octohedrons, and in deeply purplish masses, compact, small granular and large granular cleavage pieces. It is chiefly notable as the supporting substance of the De Saulesite. It is largely associated with the beautiful yellow sphalerite.

6. *Apatite.*—The speaker noticed this species on a small specimen showing an intimate mixture of the purple fluorite with yellow garnet. The apatite occurs in small prismatic crystals of bluish-green color. The combination is $P\,\infty.\ 0\,P.\ 2\,P\,2.$